LARGE CAPACITY PITFALL TRAP[1]

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ABSTRACT: Describes materials, procedures, advantages and disadvantages of using large capacity pitfall traps to inventory ground-dwelling fauna in spruce-fir forests.

Numerous investigators have designed and used pitfall traps for collecting ground-inhabiting arthropods (see Southwood, 1966 and Thiele, 1977 for a general account; and Uetz and Unzicker, 1976 for a critical review). The simplest design is a cup, jar, can or bottle sunk into the ground so that the mouth is level with the soil surface. Walking insects and other arthropods fall into the trap and are retained by a preservative or killing agent. More elaborate designs include traps with funnels, roofs, barriers, aprons and time-sort devices.

As part of a study on natural enemies of the eastern spruce budworm, *Choristoneura fumiferana* (Clem.), pitfall traps were used to inventory the ground-dwelling fauna. Spruce budworms are susceptible to predation from ground-inhabiting predators during the spring and summer larval-dispersal periods, and when large larvae and pupae drop from host trees to the forest floor. Because our study spanned the spring rainy season, a large capacity pitfall trap, which would not overflow, was needed. This Note describes the materials, procedures, advantages and disadvantages of using these large capacity traps.

MATERIALS

The components needed for construction of the traps are readily available from most scientific stockrooms or biological supply houses and from hardware/lumber yards. Each trap (Fig. 1) consists of a 150 mm plastic funnel, a 2-liter plastic bottle, and a 30 x 30 x 0.6 cm apron fashioned from tempered

[1]Received November 6, 1978. Cooperative Forestry Research Unit, Journal Article Series No. 7.

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ENT. NEWS 90 (1) 51-54. February 1979

hardboard. The funnel has a 15.4 cm outside diameter, tapering to a straight sided spout with a 2.54 cm diameter hole. The spout fits snugly into the neck of the 2-liter bottle, thus alleviating the necessity for a clamping device.

The hardboard (0.6 cm stock) is cut into a piece 30 cm^2 to form an apron. A sabre saw is then used to cut a 14.9 cm diameter hole in the center of the board. The hole is tapered to provide an optimum fit between the funnel and board. Reinforcing ridges along the funnel sides are trimmed with a knife to allow smooth contact between the funnel and tapered hole. Cut aprons are treated (2 coats) with polyurethane varnish to prevent warping.

INSTALLATION AND SERVICE

Traps were installed in the field by digging 20-25 cm diameter holes with a sharp-nose spade. Care was taken to dig a vertical hole only slightly larger than the bottle and funnel, and yet deep enough to allow the bottle to swing freely off the hole bottom. Aprons were placed over the holes and the bottle-funnel unit suspended from the board (Fig.1).

A 1:1 mixture of ethylene glycol and 70% ethanol was added to each trap bottle as a killing-preservative agent. We used ca. 300 ml of this mixture per bottle, thus allowing ample space for dilution by rain.

Traps were installed in both strip-cut and dense spruce-fir forests of northern Maine. They were serviced weekly by: 1) lifting out the funnel-

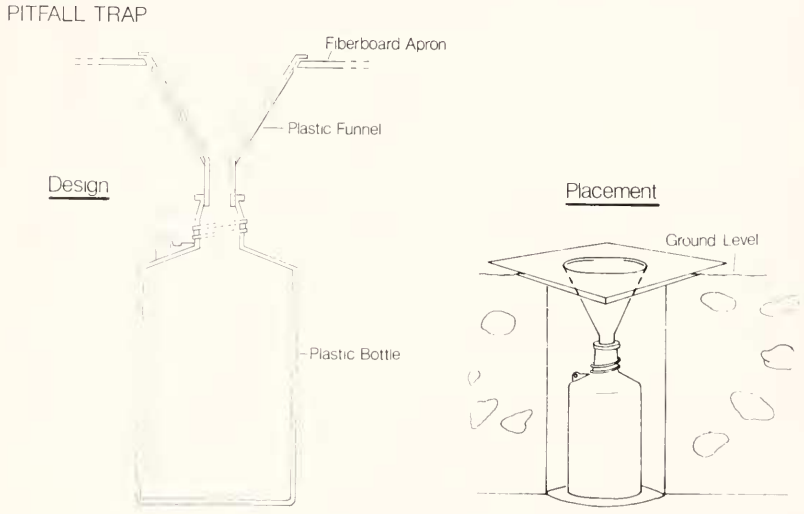

Fig. 1. Design and placement of large capacity pitfall trap.

bottle unit, 2) removing the funnel, 3) swirling the liquid around in the bottle, 4) emptying the liquid and trapped contents into a wire-mesh strainer, and 5) rinsing the strainer with trapped contents into a large collecting jar. Part of the liquid was saved and used to rinse the strainer; part was added to each collecting jar for transportation and temporary storage. Additional ethanol was added to the collecting jars since they were kept a period of time before sorting.

To replenish the liquid in each trap bottle, a fresh mixture of 1:1 ethylene glycol/ethanol was added to any excess, diluted solution. Bottle and funnel were then reassembled and placed back in the apron hole. In most cases, aprons were left in place, thus habitat disturbance was kept to a minimum.

ADVANTAGES/DISADVANTAGES

These large capacity pitfall traps are simple, easily constructed, easily serviced and relatively inexpensive. Approximate costs of materials per trap are:

150 mm Nalgene[R] plastic funnel	$0.34
2-liter, narrow-mouth Nalgene plastic bottle	0.71
30 x 30 x 0.6 cm tempered hardboard	0.19

Total cost of materials was ca. $1.24 per trap.

[R]Use of registered trademarks does not constitute endorsement.

Care should be taken to purchase only bottles and funnels that fit properly together. A loose fit or too tight a fit prevents proper union of the bottle and funnel, thus presenting problems during installation and servicing.

A rain cover was not used in our pitfall-trap studies, although one could easily be added if desired. However, such structures may attract or repel certain arthropods. Morrill (1975) found that a greater variety of insects were captured in traps without covers than those with covers. One distinct disadvantage of coverless traps is the possible inclusion of aerial dispersing forms, such as ballooning spiders.

The principal advantage of a large capacity trap can quickly be realized during rainy weather. Our collections were made weekly; at most 1 liter of liquid had accumulated in some bottles. A screen covered hole could be cut and installed in the upper portion of the bottle to allow excess fluid to drain while retaining the pitfall sample; however, this was not needed during our study.

Like Wojcik, et al., 1972, we experienced some problems with traps floating out of the ground, especially in wet areas. This problem was easily rectified

by attaching weights to the sides of the bottles.

The particle board aprons are an essential component of our trap design. They serve as a support for suspending the funnel-bottle unit and provide a runway for surface arthropods. Cutler, Grim and Kulman (1975) found that traps with aprons caught twice as many dionychous spiders compared to traps without aprons. The aprons should be varnished to prevent warping.

Our trap has been successfully used to compare the ground-invertebrate fauna of strip-cut and dense spruce-fir forests of northern Maine. We have collected spiders, carabid beetles, ants, opilionids and a variety of other arthropods, including larvae of the spruce budworm. Shrews, frogs and salamanders have also been captured without damage to the traps, although one frog did plug a funnel spout. Bears ripped some traps out of the ground and chewed the bottles and funnels; however, this destruction is probably not unique to our trap design. In general the traps are durable and can be re-used for several seasons.

ACKNOWLEDGEMENTS

We are grateful to Drs. C.D. Dondale, H.M. Kulman, R.M. Reeves, F.B. Knight and G.W. Simpson for their review comments. Also, we appreciate the talents of Mr. Wayne N. Dixon for illustrating Figure 1.

LITERATURE CITED

Cutler, Bruce, Lee H. Grim and H.M. Kulman. 1975. A study in the summer phenology of dionychious spiders from northern Minnesota forests. Great Lakes Entomologist 8(3):99-104.

Morrill, Wendell L. 1975. Plastic pitfall trap. Environ. Entomol. 4:596.

Southwood, T.R.E. 1966. Ecological methods with particular reference to the study of insect populations.(Reprinted 1976) Chapman and Hall Ltd., London. 391 p.

Thiele, H.U. 1977. Carabid beetles in their environments. A study on habitat selection by adaptations in physiology and behavior. Springer-Verlag. Berlin Heidelberg, Germany. Vol. 10, 380 p.

Uetz, G.W. and J.D. Unzicker. 1976. Pitfall trapping in ecological studies of wandering spiders. J. Arachnol. 3:101-111.

Wojcik, Daniel P., W.A. Banks, D.M. Hicks, and J.K. Plumley. 1972. A simple inexpensive pitfall trap for collecting arthropods. Fla. Entomologist 55(2):115-116.